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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/816,978	MATSUMOTO, KAZUHIKO	
	Examiner	Art Unit	
	KATRINA FUJITA	2624	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *29 January 2009*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-36* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-36* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on January 29, 2009 has been entered.

Response to Amendment

2. This Office Action is responsive to Applicant's remarks received on January 29, 2009. Claims 1-36 remain pending.

Claim Objections

3. The previous claim objection is withdrawn in light of Applicant’s amendment.

4. The following is a quotation of 37 CFR 1.75(a):

> The specification must conclude with a claim particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention or discovery.

5. Claim 19 is objected to under 37 CFR 1.75(a), as failing to particularly point out and distinctly claim the subject matter which application regards as his invention or discovery.

Claim 19 lacks antecedent basis for “said regions specifying unit” in line 15. The following will be assumed for examination purposes: -- ~~said~~ a regions specifying unit --.

Claim Rejections - 35 USC § 112

6. Claims 1-18 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Claim 1 recites “establishing an orthogonal cross sectional region to the longitudinal direction of the target vessel by marching along the target vessel without having first determined a center point of each vessel”. However, in the specification at page 32, line 18, it is stated that the control unit “specifies a region (surface) (hereinafter referred to as ‘orthogonal cross sectional region SR) in whose center the start point SP is positioned". SP is described at page 32, line 10 as being “the center of the displayed cross sectional view”. Therefore, as the specification describes the orthogonal cross sectional region to be establish after first

determining a center point of the vessel, the addition of the limitation "without having first determined a center point of each vessel" is unsupported by the specification.

35 USC § 101

7. The method of claims 19-36 are shown to successfully transform an article to a different state as they modify data representing a physical object (vessel data of a patient) and depict the modified data (generation of a medical image of the modified data implies a depiction) in the critical processing steps of the method.

Claim Rejections - 35 USC § 102

8. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

9. Claims 19-31 and 33-36 are rejected under 35 U.S.C. 102(e) as being anticipated by Suri et al. (US 6,842,638).

Regarding **claim 19**, Suri et al. discloses a medical image processing method for generating an image representing a tubular tissue of a target vessel ("apparatus is disclosed for producing an angiographic image representation of a subject" at col. 2, line 64) in a living body by using a computer ("three-dimensional gray scale image representation of the examined area of the patient" at col. 7, line 58), said apparatus comprising:

a step of obtaining predetermined three-dimensional volume data including a tubular tissue of the target vessel ("the carotid area of the patient 42 is imaged" at col. 7, line 40);

a step of specifying a region ("orthogonal plane" at col. 18, line 4) including a position on the tubular tissue (figure 23, numeral 610) in the three-dimensional volume data, at each of a plurality of such positions ("process is repeated 618, by selecting 612 a new point 614" at col. 18, line 14) as said region specifying unit specifies a planar region which orthogonally intersects with the longitudinal direction of the tubular tissue ("orthogonal plane 94" at col. 18, line 4), said step of specifying a region including establishing a region threshold and excluding areas beyond said threshold from said planar region ("a low thresholding value will appropriately set the vessel contours 342, 344 to binary one imposed on a binary zero background, thus forming closed binary contour edges of the vessel structures" at col. 15, line 51) thereby distinguishing adjacent vessels from said target vessel ("provides locations of furcation and vessel

overlap points" at col. 4, line 23; "artery-vein separation" at col. 9, line 46, implying distinguishing an artery from a vein that's adjacent to it);

a step of extracting information on the tubular tissue in each of the plurality of specified regions ("finding the extent of the vessel" at col. 17, line 67);

a step of specifying a center position of a cross section of the tubular tissue in each of the plurality of regions specified by a region specifying unit ("locating the next vessel center" at col. 18, line 2); and

a step of generating a medical image representing the tubular tissue, based on the information ("segmented vascular information is preferably graphically displayed on an appropriate user interface 54, typically as a two-dimensional or three-dimensional graphical image representation" at col. 8, line 33).

Regarding **claim 20**, Suri et al. discloses method wherein said step of extracting information on the tubular tissue includes:

a step of specifying a center position of a cross section of the tubular tissue in each of the plurality of specified regions ("finding the vessel center; (3) finding the extent of the vessel above the vessel center" at col. 17, line 67); and

a step of specifying a center line of the tubular tissue in a longitudinal direction of the tubular tissue, based on the plurality of center positions specified by said center specifying unit ("vascular path 96' is obtained" at col. 18, line 19).

Regarding **claim 21**, Suri et al. discloses a method wherein:

in said step of specifying a region, regions are sequentially specified along the tubular tissue ("process is repeated 618, by selecting 612 a new point 614" at col. 18, line 14); and

in said step of specifying a center position, a center position of a cross section of the tubular tissue in each of the regions sequentially specified by said region specifying unit ("locating the next vessel center" at col. 18, line 2).

Regarding **claim 22**, Suri et al. discloses a method wherein:

in said step of specifying a region, a planar region which orthogonally intersects with the longitudinal direction of the tubular tissue is specified ("finding the extent of the vessel above the vessel center in the plane orthogonal to the vessel direction" at col. 17, line 67).

Regarding **claim 23**, Suri et al. discloses a method wherein said step of extracting information includes:

a step of obtaining a median point of the tubular tissue represented by the three-dimensional volume data in each of the plurality of specified regions ("vessel center" at col. 17, line 67);

a step of generating a cross sectional image representing a cross section of the tubular tissue at a position of the median point obtained in said step of obtaining a median point ("finding the extent of the vessel above the vessel center" at col. 17, line 67); and

a step of specifying a center position of the cross section in the three-dimensional volume data, based on the generated cross sectional image ("finding the

vessel center; (3) finding the extent of the vessel above the vessel center" at col. 17, line 67).

Regarding **claim 24**, Suri et al. discloses a method further comprising a step of receiving designation for two arbitrary points on the tubular tissue represented by the three-dimensional volume data ("starting point" at col. 17, line 58 and a subsequent point as "The process is repeated 618, by selecting 612 a new point 614" at col. 18, line 14),

wherein:

in said step of specifying a region, planar regions orthogonally intersecting with the longitudinal direction of the tubular tissue are sequentially specified ("finding the extent of the vessel above the vessel center in the plane orthogonal to the vessel direction" at col. 17, line 67; "repeating the process" at col. 18, line 3), at a plurality of positions between the two points along the tubular tissue (the final designated point will have a number of planar regions between it and the initial starting point); and

in said step of specifying a center position, a center of a cross section of the tubular tissue in each of the plurality of planar regions specified ("finding the vessel center" at col. 17, line 67; "repeating the process" at col. 18, line 3).

Regarding **claim 25**, Suri et al. discloses a method wherein:

in said step of receiving designation, designation for a planar region orthogonally intersecting with the longitudinal direction of the tubular tissue at one of the two designated points ("finding the extent of the vessel about the vessel center in the plane orthogonal to the vessel direction" at col. 17, line 67);

in said step of specifying a region, points apart from one another by a predetermined distance are sequentially specified along the tubular tissue in a direction heading from the one point to the other point of the two points, ("selecting 612 advantageously moves a pre-selected distance along the vessel direction" at col. 18, line 15), and planar regions orthogonally intersecting with the longitudinal direction of the tubular tissue at each of the specified points are sequentially specified ("finding the extent of the vessel above the vessel center in the plane orthogonal to the vessel direction" at col. 17, line 67; "repeating the process" at col. 18, line 3);

in said step of specifying a center position, a center position of a cross section of the tubular tissue in each of the specified planar regions specified is specified ("finding the vessel center" at col. 17, line 67; "repeating the process" at col. 18, line 3); and

in said step of specifying a center line, a center line of the tubular tissue in the longitudinal direction of the tubular tissue is specified based on the specified center positions ("vascular path 96' is obtained" at col. 18, line 19).

Regarding **claim 26**, Suri et al. discloses a method wherein:

the three-dimensional volume data includes three-dimensional coordinate information ("count and location 390 of the vessel structures" at col. 15, line 61) and characteristic information representing a characteristic unique to a substance at each position represented by the three-dimensional coordinate information ('angiographic data based on the edge volume 80 is advantageous because it retains the vessel lumen information" at col. 8, line 62); and

in said step of generating a cross sectional image, an image is generated based on information representing a three-dimensional coordinate position having the characteristic information satisfying a predetermined condition in the three-dimensional volume data (figure 15, numeral 386; "performs pre-filtering to remove noise or extraneous features such as non-vascular contrast that interferes with the vascular image" at col. 8, line 3), and clarifies the cross section of the tubular tissue in the image ("flood-filled vessel structures" at col. 15, line 55).

Regarding **claim 27**, Suri et al. discloses a method wherein said step of generating a cross sectional image includes:

a step of changing the predetermined condition (the pre-processing conditions will change depending on whether the study type is BBA or not);

a step of detecting an image attribute which changes in accordance with changes in the predetermined condition ("For each pixel (r,c) of the slice 386 having flood-filled vessel structures, the top four values A,B,C,D around (r,c) are obtained" at col. 16, line 61; as the result of the flood-filling changes depending on the input data, it will change depending on whether the study type is BBA or not); and

a step of determining whether or not the cross section of the tubular tissue is clarified in an image, based on detected changes in the image attribute ("recursive erosion process of FIGS. 20 and 21 is repeated until the final vessel centers are obtained" at col. 17, line 30).

Regarding **claim 28,** Suri et al. discloses a method wherein:

the image attribute represents an area of an image (the pixel values represent the area from which they are extracted as shown in figure 19);

in said step of detecting an image area which changes in accordance with changes in the predetermined condition (as the result of the flood-filling changes depending on the input data, it will change depending on whether the study type is BBA or not), and detects a change in the image area corresponding to the changes in the predetermined condition ('add/replacement processor 508 adds one to the minimum value 506 and replaces the pixel (r,c) with the new value" at col. 17, line 1); and

in said step of determining whether or not the cross section of the tubular tissue is clarified, based on the detected change in the image area ("transform of equation (13) is repeated 542, 544 for each pixel to produce the eroded image" at col. 17, line 28).

Regarding **claim 29**, Suri et al. discloses a method

wherein said step of determining that the cross section of the tubular tissue is clarified in the image, when an image appearing in a center of the region including the cross section become fit inside the region, and the change in the image area becomes the largest (figure 17D).

Regarding **claim 30**, Suri et al. discloses a method

wherein said step of determining a position of a three-dimensional region to be specified next ("selecting 612 advantageously moves a pre-selected distance along the vessel direction" at col. 18, line 15), based on the three-dimensional volume data which is specified by said center line specifying unit and which represents the center line of

the tubular tissue ("starting point is optionally selected from the table of vessel center tags" at col. 17, line 63).

Regarding **claim 31**, Suri et al. discloses a method wherein:

said step of specifying the center line of the tubular tissue as three-dimensional path data ("vascular path 96' is obtained" at col. 18, line 19); and

said step of generating an image representing the tubular tissue based on the three-dimensional path data specified by said center line specifying unit ("Once the vessel termination is reached, a vascular path 96' is obtained" at col. 18, line 19).

Regarding **claim 33**, Suri et al. discloses a method wherein:

said step of specifying a predetermined three-dimensional region whose center is an arbitrary point on the predetermined tubular tissue represented by the three-dimensional volume data ("starting point is typically a root of the venous or arterial system of interest, and can optionally be selected manually or identified using an automated system" at col. 17, line 58);

said step of clarifying a three-dimensional image representing only the predetermined tubular tissue in the specified three-dimensional region (figure 15, numeral 80), by changing predetermined characteristic information included in the three-dimensional volume data which constitutes a three-dimensional image obtained by data-conversion of said imaging unit ('add/replacement processor 508 adds one to the minimum value 506 and replaces the pixel (r,c) with the new value" at col. 17, line 1); and

said step of generating a predetermined medical image representing the predetermined tubular tissue, by using the three-dimensional image clarified by said image clarifying unit (figure 29, numeral 780).

Regarding **claim 34**, Suri et al. discloses a method wherein:

said step of clarifying an image

a step of detecting a closed region which constitutes the three-dimensional image obtained by data-conversion of said imaging unit and which includes a center of the three-dimensional region (figure 17C), and

a step of determining based on the detected closed region and the three-dimensional region whether or not the closed region represents only the predetermined tubular tissue ("recursive erosion process of FIGS. 20 and 21 is repeated until the final vessel centers are obtained" at col. 17, line 30); and

the closed region which is determined by said clarification determining unit as representing only the predetermined tubular tissue is regarded as the clarified three-dimensional image (figure 17D).

Regarding **claim 35**, Suri et al. discloses a method wherein:

said step of detecting a change in the closed region corresponding to changes in the characteristic information (as the result of the flood-filling changes depending on the input data, it will change depending on whether the study type is BBA or not); and

said step of determining whether or not the closed region represents only the predetermined tubular tissue, based on changes in the closed region ("transform of

equation (13) is repeated 542, 544 for each pixel to produce the eroded image" at col. 17, line 28).

Regarding **claim 36**, Suri et al. discloses a method wherein:

said step of specifying a plurality of three-dimensional regions by setting a center of a three-dimensional region to be specified next based on the arbitrary point and/or the clarified three-dimensional image ("starting point is typically a root of the venous or arterial system of interest, and can optionally be selected manually or identified using an automated system" at col. 17, line 58); and

said step of generating the predetermined medical image representing the predetermined tubular tissue, by using three-dimensional images clarified in the plurality of three-dimensional regions (figure 29, numeral 780).

Claim Rejections - 35 USC § 103

10. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

11. Claims 1-13 and 15-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Suri et al.

Regarding **claim 1**, Suri et al. discloses a medical image processing apparatus for generating a medical image of a target vessel (“apparatus is disclosed for producing an angiographic image representation of a subject" at col. 2, line 64) by using three-dimensional volume data representing a portion in a living body (“three-dimensional gray scale image representation of the examined area of the patient" at col. 7, line 58), said apparatus comprising:

a volume data obtaining unit (figure 4, numeral 40) which obtains predetermined three-dimensional volume data including a tubular tissue of the target vessel (“the carotid area of the patient 42 is imaged" at col. 7, line 40);

a region specifying unit (figure 23, numeral 94) which specifies a region ("orthogonal plane" at col. 18, line 4) including a position on the tubular tissue (figure 23, numeral 610) in the three-dimensional volume data, at each of a plurality of such positions (“process is repeated 618, by selecting 612 a new point 614" at col. 18, line 14) as said region specifying unit specifies a planar region which orthogonally intersects with the longitudinal direction of the tubular tissue (“orthogonal plane 94” at col. 18, line 4), said region specifying unit establishing an orthogonal cross sectional region to the longitudinal direction of the target vessel by marching along the target vessel (“selecting 612 advantageously moves a pre-selected distance along the vessel direction” at col. 18, line 15);

an extraction unit (figure 23, numeral 86) which extracts information on the tubular tissue in each of the specified regions (“finding the extent of the vessel” at col. 17, line 67);

a center specifying unit (figure 23, numeral 614) for specifying a center position of a cross section of the tubular tissue in each of the plurality of regions specified by said region specifying unit ("locating the next vessel center" at col. 18, line 2); and

a medical image generating unit (figure 4, numeral 54) which generates a medical image representing the tubular tissue, based on the information extracted by said extraction unit ("segmented vascular information is preferably graphically displayed on an appropriate user interface 54, typically as a two-dimensional or three-dimensional graphical image representation" at col. 8, line 33).

Suri et al. does not explicitly disclose establishing an orthogonal cross sectional region to the longitudinal direction of the target vessel by marching along the target vessel without having first determined a center point of each vessel.

However, Suri et al. discloses that the starting point does not need to be a center point of the vessel ("starting point is optionally selected from the table of vessel center tags" at col. 17, line 63) and therefore, the orthogonal cross section would be generated at a point not at the vessel center.

Therefore, it would have been obvious at the time the invention was made to one of ordinary skill in the art to generate the orthogonal plane not at the vessel center such that there is more degree of freedom for the starting point.

Regarding **claim 2**, Suri et al. discloses an apparatus wherein:

each of the plurality of regions are specified by said region specifying unit (figure 23, numeral 94) based on the three-dimensional volume data obtained by the volume

data obtaining unit ("selecting 612 advantageously moves a pre-selected distance along the vessel direction" at col. 18, line 15); and

a center line specifying unit (figure 23, numeral 96') which specifies a center line of the tubular tissue in a longitudinal direction of the tubular tissue, based on the plurality of center positions specified by said center specifying unit ("vascular path 96' is obtained" at col. 18, line 19).

Regarding **claim 3**, Suri et al. discloses an apparatus wherein:

said region specifying unit sequentially specifies regions along the tubular tissue ("process is repeated 618, by selecting 612 a new point 614" at col. 18, line 14); and

said center specifying unit specifies a center of a cross section of the tubular tissue in each of the regions sequentially specified by said region specifying unit ("locating the next vessel center" at col. 18, line 2).

Regarding **claim 4**, Suri et al. discloses an apparatus wherein:

said center specifying unit specifies a center position of a cross section of the tubular tissue in the planar region specified by said region specifying unit ("finding the extent of the vessel above the vessel center in the plane orthogonal to the vessel direction" at col. 17, line 67).

Regarding **claim 5**, Suri et al. discloses an apparatus wherein said extraction unit includes:

a unit (figure 23, numeral 612) which obtains a median point represented by the three-dimensional volume data, of the tubular tissue in each of the plurality of regions specified by said region specifying unit ("vessel center" at col. 17, line 67);

a cross sectional image generation unit (figure 23, numeral 86) which generates a cross sectional image representing a cross section of the tubular tissue at a position of the median point obtained by said unit for obtaining a median point ("finding the extent of the vessel above the vessel center" at col. 17, line 67); and

a center specifying unit (figure 23, numeral 614) which specifies a center position of the cross section in the three-dimensional volume data, based on the generated cross sectional image ("finding the vessel center; (3) finding the extent of the vessel above the vessel center" at col. 17, line 67).

Regarding **claim 6**, Suri et al. discloses an apparatus further comprising a designation reception unit (figure 23, numeral 610) which receives designation for two arbitrary points on the tubular tissue represented by the three-dimensional volume data ("starting point" at col. 17, line 58 and a subsequent point as "The process is repeated 618, by selecting 612 a new point 614" at col. 18, line 14),

wherein:

said region specifying unit sequentially specifies planar regions which orthogonally intersect with the longitudinal direction of the tubular tissue ("finding the extent of the vessel above the vessel center in the plane orthogonal to the vessel direction" at col. 17, line 67; "repeating the process" at col. 18, line 3), at a plurality of positions between the two points along the tubular tissue (the final designated point will have a number of planar regions between it and the initial starting point); and

said center specifying unit specifies a center of a cross section of the tubular tissue in each of the plurality of planar regions specified by said region specifying unit ("finding the vessel center" at col. 17, line 67; "repeating the process" at col. 18, line 3).

Regarding **claim 7**, Suri et al. discloses an apparatus wherein:

said designation reception unit receives designation for a planar region which orthogonally intersects with the longitudinal direction of the tubular tissue, at one of the two designated points ("finding the extent of the vessel about the vessel center in the plane orthogonal to the vessel direction" at col. 17, line 67);

said region specifying unit sequentially specifies points which are apart from one another by a predetermined distance in a direction heading from the one point to the other point of the two points along the tubular tissue ("selecting 612 advantageously moves a pre-selected distance along the vessel direction" at col. 18, line 15), and sequentially specifies planar regions orthogonally intersecting with the longitudinal direction of the tubular tissue at each of the specified points ("finding the extent of the vessel above the vessel center in the plane orthogonal to the vessel direction" at col. 17, line 67; "repeating the process" at col. 18, line 3);

said center specifying unit specifies a center position of a cross section of the tubular tissue in each of the plurality of planar regions specified by said region specifying unit ("finding the vessel center" at col. 17, line 67; "repeating the process" at col. 18, line 3); and

said center line specifying unit specifies a center line of the tubular tissue in the longitudinal direction of the tubular tissue, based on the plurality of center positions

specified by said center specifying unit ("vascular path 96' is obtained" at col. 18, line 19).

Regarding **claim 8**, Suri et al. discloses an apparatus wherein:

the three-dimensional volume data includes three-dimensional coordinate information ("count and location 390 of the vessel structures" at col. 15, line 61) and characteristic information representing a characteristic unique to a substance at each position represented by the three-dimensional coordinate information ('angiographic data based on the edge volume 80 is advantageous because it retains the vessel lumen information" at col. 8, line 62); and

said cross sectional image generation unit generates an image based on information representing a three-dimensional coordinate position having the characteristic information which satisfies a predetermined condition in the three-dimensional volume data (figure 15, numeral 386; "performs pre-filtering to remove noise or extraneous features such as non-vascular contrast that interferes with the vascular image" at col. 8, line 3), and clarifies the cross section of the tubular tissue in the image ("flood-filled vessel structures" at col. 15, line 55).

Regarding **claim 9**, Suri et al. discloses an apparatus wherein said imaging unit comprises:

a condition changing unit (figure 4, numeral 46) which changes the predetermined condition (the pre-processing conditions will change depending on whether the study type is BBA or not);

an image attribute detecting unit (figure 20) which detects an image attribute which changes in accordance with changes in the predetermined condition ("For each pixel (r,c) of the slice 386 having flood-filled vessel structures, the top four values A,B,C,D around (r,c) are obtained" at col. 16, line 61; as the result of the flood-filling changes depending on the input data, it will change depending on whether the study type is BBA or not); and

a clarification determining unit (portion of figure 16, numeral 400 that conducts figure 21, numeral 542) which determines whether or not the cross section of the tubular tissue is clarified in an image, based on detected changes in the image attribute ("recursive erosion process of FIGS. 20 and 21 is repeated until the final vessel centers are obtained" at col. 17, line 30).

Regarding **claim 10,** Suri et al. discloses an apparatus wherein:

the image attribute represents an area of an image (the pixel values represent the area from which they are extracted as shown in figure 19);

said image attribute detecting unit detects an image area which changes in accordance with changes in the predetermined condition (as the result of the flood-filling changes depending on the input data, it will change depending on whether the study type is BBA or not), and detects a change in the image area corresponding to the changes in the predetermined condition ('add/replacement processor 508 adds one to the minimum value 506 and replaces the pixel (r,c) with the new value" at col. 17, line 1); and

said clarification determining unit determines whether or not the cross section of the tubular tissue is clarified, based on the detected change in the image area ("transform of equation (13) is repeated 542, 544 for each pixel to produce the eroded image" at col. 17, line 28).

Regarding **claim 11**, Suri et al. discloses an apparatus

wherein said clarification determining unit determines that the cross section of the tubular tissue is clarified in the image (figure 21, numeral 546), when an image appearing in a center of the region including the cross section become fit inside the region, and the change in the image area becomes the largest (figure 17D).

Regarding **claim 12**, Suri et al. discloses an apparatus

wherein said region specifying unit determines a position of a three-dimensional region to be specified next ("selecting 612 advantageously moves a pre-selected distance along the vessel direction" at col. 18, line 15), based on the three-dimensional volume data which is specified by said center line specifying unit and which represents the center line of the tubular tissue ("starting point is optionally selected from the table of vessel center tags" at col. 17, line 63).

Regarding **claim 13**, Suri et al. discloses an apparatus wherein:

said center line specifying unit specifies the center line of the tubular tissue as three-dimensional path data ("vascular path 96' is obtained" at col. 18, line 19); and

said medical image processing apparatus further comprises an image generating unit (portion of figure 4, numeral 52 that produces figure 23, numeral 96') which generates an image representing the tubular tissue based on the three-dimensional

path data specified by said center line specifying unit ("Once the vessel termination is reached, a vascular path 96' is obtained" at col. 18, line 19).

Regarding **claim 15**, Suri et al. discloses an apparatus wherein:

said region specifying unit specifies a predetermined three-dimensional region whose center is an arbitrary point on the predetermined tubular tissue represented by the three-dimensional volume data ("starting point is typically a root of the venous or arterial system of interest, and can optionally be selected manually or identified using an automated system" at col. 17, line 58);

said medical image processing apparatus further comprises an image clarifying unit (portion of figure 5, numeral 70 that conducts figures 20 and 21) which clarifies a three-dimensional image representing only the predetermined tubular tissue in the specified three-dimensional region (figure 15, numeral 80), by changing predetermined characteristic information included in the three-dimensional volume data which constitutes a three-dimensional image obtained by data-conversion of said imaging unit ('add/replacement processor 508 adds one to the minimum value 506 and replaces the pixel (r,c) with the new value" at col. 17, line 1); and

said medical image generating unit generates a predetermined medical image representing the predetermined tubular tissue, by using the three-dimensional image clarified by said image clarifying unit (figure 29, numeral 780).

Regarding **claim 16**, Suri et al. discloses an apparatus wherein:

said image clarifying unit comprises

a closed region detecting unit (figure 20, numeral 512) which detects a closed region which constitutes the three-dimensional image obtained by data-conversion of said imaging unit and which includes a center of the three-dimensional region (figure 17C), and

a clarification determining unit (portion of figure 16, numeral 400 that conducts figure 21, numeral 542) which determines based on the closed region detected by said closed region detecting unit and the three-dimensional region whether or not the closed region represents only the predetermined tubular tissue ("recursive erosion process of FIGS. 20 and 21 is repeated until the final vessel centers are obtained" at col. 17, line 30); and

the closed region which is determined by said clarification determining unit as representing only the predetermined tubular tissue is regarded as the clarified three-dimensional image (figure 17D).

Regarding **claim 17**, Suri et al. discloses an apparatus wherein:

said closed region detecting unit detects a change in the closed region corresponding to changes in the characteristic information (as the result of the flood-filling changes depending on the input data, it will change depending on whether the study type is BBA or not); and

said clarification determining unit determines whether or not the closed region represents only the predetermined tubular tissue, based on changes in the closed region ("transform of equation (13) is repeated 542, 544 for each pixel to produce the eroded image" at col. 17, line 28).

Regarding **claim 18**, Suri et al. discloses an apparatus wherein:

said region specifying unit specifies a plurality of three-dimensional regions by setting a center of a three-dimensional region to be specified next based on the arbitrary point and/or the clarified three-dimensional image ("starting point is typically a root of the venous or arterial system of interest, and can optionally be selected manually or identified using an automated system" at col. 17, line 58); and

said medical image generating unit generates the predetermined medical image representing the predetermined tubular tissue, by using three-dimensional images clarified in the plurality of three-dimensional regions (figure 29, numeral 780).

12. Claims 14 and 32 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination Suri et al. and Johnson et al. (US 5,891,030).

Suri et al. discloses an apparatus and method wherein said image generating unit comprises:

an image calculating unit which generates plural kinds of images each representing the tubular tissue (figure 23, numeral 616; figure 23, numeral 96'), and calculates relative positional relationships between the images ("finding the extent of the vessel about the vessel center in the plane orthogonal to the vessel direction; (4) locating the next vessel center" at col. 17, line 67).

Suri et al. does not disclose a display control unit which displays the generated plural kinds of images all at once on a predetermined display device, and displays positional relationships on the displayed images by associating the relations based on

the relative positional relationships between the images calculated by said image calculating unit.

Johnson et al. teaches medical image processing apparatus and method for generating a medical image by using three-dimensional volume data representing a portion in a living body ("anatomical modeling of the human body with a computer, and more particularly to a computerized system for analyzing tubular structures of the human body" at col. 1, line 8), said apparatus comprising:

a display control unit (figure 3, numeral 48) which displays the generated plural kinds of images all at once on a predetermined display device ("the two dimensional reformatted images and the three dimensional intraluminal image of the structure are dynamically simultaneously displayed to the user on the display device" at col. 6, line 7), and displays positional relationships on the displayed images by associating the relations based on the relative positional relationships between the images ("Fiducial marks shown within each of the displayed views provide three dimensional localization. As the three dimensional course of the colon is delineated, the colon midline is preferably superimposed over the scout views and intersections with cross sections are displayed" at col. 7, line 9) calculated by said image calculating unit (figure 2, numeral 30).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to utilize the display processing of Johnson et al. to present the image data of Suri et al. as "simultaneous display of cross-sectional and rendered views

enhances a diagnostic interpretation more than either cross-sectional or intra luminal views alone" (Johnson et al. at col. 2, line 53).

Response to Arguments

Summary of Arguments (@ response page labeled 17): The Suri reference determines vessel centers prior to determining the cross sections and therefore does not meet the added limitation of claim 1.

Examiner's Response: The Examiner points out in the modified rejections above that the initial starting point may be chosen at a point other than the vessel center and therefore would meet the new limitation of claim 1.

Summary of Arguments (@ response page labeled 20): The Suri reference "does not provide the ability to distinguish between adjacent vessel Vt and Vx".

Examiner's Response: The Suri reference states that it is able to distinguish between veins and arteries during tracking such that tracking of a particular vein does not erroneously track into the artery if it overlaps or intertwines with the vein, thereby distinguishing between adjacent vessels.

Conclusion

13. Any inquiry concerning this communication or earlier communications from the examiner should be directed to KATRINA FUJITA whose telephone number is (571)270-1574. The examiner can normally be reached on M-Th 8-5:30pm, F 8-4:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Bhavesh Mehta can be reached on (571) 272-7453. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Katrina Fujita/
Examiner, Art Unit 2624

/Bhavesh M Mehta/
Supervisory Patent Examiner, Art Unit 2624